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EFFECT OF THE LEVEL OF ANIMAL FAT IN THE DIET ON THE MAINTENANCE, REPRODUCTION AND LACTATION PERFORMANCE OF DOGS ¹

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ONE FIGURE

In experiments reported previously (Siedler and Schweigert, '52), the effects of added stabilized animal fat in the diet on the rate of growth, general health and appearance, and food utilization of weanling Cocker Spaniel pups were studied. The results showed that the added fat was well utilized by the growing pups. It was of importance to extend these studies to measurements of the reproduction and lactation performances when animal fats were added to the ration. Deuel et al. ('47) found that the reproduction and lactation capacity of rats fed a semi-purified diet was increased by the addition of fat to the diet. Other workers (Nelson and Evans, '47, '47a) have reported adverse effects on the reproduction and lactation performances of rats fed a purified diet to which various levels of fat had been added. It may be concluded from these and other studies that the effects observed with additions of fat to the ration are closely related to the adequacy of the ra-

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tion in other nutrients. Dilution of protein, minerals and vitamins by added fat may result in sub-optimal levels of these nutrients in the ration, and an inferior performance of the animals would be observed.

In the present studies, observations have been made on the maintenance, reproduction and lactation performance of registered Cocker Spaniel females which have been fed practical type rations, either with or without stabilized fat added.

EXPERIMENTAL

Registered Cocker Spaniel females were maintained in the same experimental feeding groups as reported previously for the growth studies (Siedler and Schweigert, '52). The experimental rations fed consisted of a basal ration composed of ingredients commonly used in dry meals either with or without 4 or 8% stabilized choice white grease (rendered pork fat) or 18% sucrose added at the expense of the ration. The sucrose was fed at a level to approximate the crude calories contributed by 8% fat. The fat was stabilized with an antioxidant mixture, as reported previously.

The dogs were weighed at weekly intervals throughout the experiment. Food intake was recorded for a three-week period when the dogs were approximately 6-7 months of age (prior to breeding) to determine the amount of the various rations needed for maintenance of body weight.

The dogs were examined bi-weekly for estrus, and at estrus were bred to one of the two studs retained from the previous experiments. The bitches were bred to the alternate stud at the estrus following birth of the first litter, whenever possible, but due to the failure of certain females to conceive after breeding or failure of females to come into estrus, it was impossible to achieve completely the objective of two litters per female during the two-year experimental period.

After parturition, the weight of the newborn pups was taken as a group. The pups were weighed individually from the first through the 7th week of age. Weaning of the pups

was begun at 5 weeks of age, and the pups were totally weaned at the end of the 6th week. The pups were fed the mother's diet from the 6th through 7th week of age, when they were removed from the experiment.

Food intakes of the lactating bitches were recorded through the first 4 weeks of lactation. Food efficiencies were then calculated from the food intakes and the weight change of the bitch and pups. Caloric efficiencies were also calculated from

TABLE 1
Maintenance data of females fed graded levels of fat
(3-week period)

RATION FED	NO. DOGS	AV. GAIN/ DOG/GROUP/ WK.	FOOD CONSUMPTION PER KG BODY WEIGHT/WK.	CALORIC CONSUMPTION PER KG BODY WEIGHT/WK.
		<i>gm</i>	<i>gm</i>	
Basal	7	7	222	792
Basal + 4% fat	7	107	218	824
Basal + 8% fat	6	20	190	755
Basal + 18% sucrose	5	30	205	747

these data and the caloric composition of the rations. The results are expressed as the grams gained by both the lactating bitch and the pups per unit of feed or caloric intake.

RESULTS AND DISCUSSION

The results obtained from the maintenance studies are shown in table 1. These results indicate that the maintenance performance of the dogs fed the basal ration plus 4 or 8% fat or 18% sucrose was equal to or better than that for dogs fed the basal ration. Since the group fed 4% added fat gained considerably more than the other groups during this period, it is difficult to make direct comparisons.

The reproduction data (table 2) show that the performance of bitches fed the basal ration plus 4% added fat was somewhat better than that for bitches fed the basal ration. The number of pups dead 24 hours after birth from the bitches fed the 4% added fat or the basal ration was negligible, and the average weights of the newborn pups were excellent from both groups.

The reproduction performances of the bitches fed the basal ration plus 8% fat indicate that dilution of other nutrients

TABLE 2
Reproduction and lactation performance of dogs fed different levels of fat

RATION FED	BASAL	BASAL 4% FAT	BASAL 8% FAT	BASAL 18% SUCROSE
Average weight at breeding, kg	8.4 \pm 1.2 ¹	9.2 \pm 1.5 ¹	8.0 \pm 0.5 ¹	7.6 \pm 1.4 ¹
Average weight gain pregnancy, kg	1.77 \pm 0.67	2.27 \pm 0.65	2.04 \pm 0.14	2.05 \pm 0.59
Average weight of newborn pups, gm	228	248	192	184
No. litters per group	11	11	8	5
Total no. pups born	54	51	49	27
Total no. pups dead 24 hrs.	4	2	9	8
Total no. pups weaned	43	47	38	14
Average weight pups 4 weeks, gm	♂ 984 \pm 198 ♀ 954 \pm 230	1,080 \pm 285 1,042 \pm 265	990 \pm 182 897 \pm 92	756 \pm 250 967 \pm 140
Average weight pups 6 weeks, gm	♂ 1,539 \pm 385 ♀ 1,342 \pm 363	1,753 \pm 275 1,593 \pm 315	1,431 \pm 390 1,278 \pm 245	1,269 \pm 485 1,367 \pm 410
Average food efficiency ²	0.25 \pm 0.06	0.30 \pm 0.07	0.33 \pm 0.07	0.22 \pm 0.06
Average caloric efficiency ³	7.1 \pm 1.7	7.9 \pm 1.8	8.3 \pm 1.7	6.05 \pm 1.6

¹ Mean and standard error.

² Gram gain per gram of food consumed (see text).

³ Gram gain per 100 crude calories consumed (see text).

may have become critical under this particular stress as indicated by the percentage of pups dead 24 hours after birth and the average size of the pups at birth as compared to those in the group fed the basal ration or basal plus 4% fat.² However, the average number of pups per litter was considerably larger than the average of the other groups tested, and this may have been a factor in these results. The reproduction capacity of the group fed the basal ration plus 18% sucrose was inferior to that observed for the other groups. Mortality of the newborn pups was quite high; however, sufficient data are not available to evaluate this group critically.

The lactation performances, including data on the number of pups weaned and the weights of the pups at 4 and 6 weeks are presented in table 2, and the rates of growth of the male and female pups from the first through the 7th week are shown in figure 1. The pups from the bitches fed 4% fat showed an increased rate of gain over those in any of the other groups. Those from the bitches fed 8% fat or 18% sucrose showed a slightly lower rate of gain than those whose mothers were fed the basal ration. One group of pups in the sucrose group was removed from the experiment at 6 weeks of age; therefore none of the data are presented for this group from the 6th to the 7th week. No differences were observed in the general appearance, health, and maintenance of body weight among the groups of females during lactation.

The differences in the rates of gain of the pups from bitches fed 4% added fat, as compared to those fed the basal ration, were evaluated statistically in view of the marked change in the slope of the two curves (fig. 1) from the 5th through the 7th week. A summary of this evaluation is shown in table 3. The rates of gain of pups from the second litters for the group fed 4% added fat were significantly greater

² A paper by Campbell and Phillips (Southwestern Vet., Winter Issue, p. 173, 1953) has come to our attention since submission of our manuscript in which these workers also observed an inferior performance of dogs fed rations containing higher levels of fat. From their work, the dilution of the ration by the addition of fat was corrected by methionine supplementation, indicating that the protein (methionine) level in the ration became limiting.

than those for pups from the basal group. The rate of gain of the second litter whose mother was fed the basal ration decreased as compared to the gain for pups from the first litter. The gains of the second litter from bitches fed 4% added fat were also greater than those from the first litter.

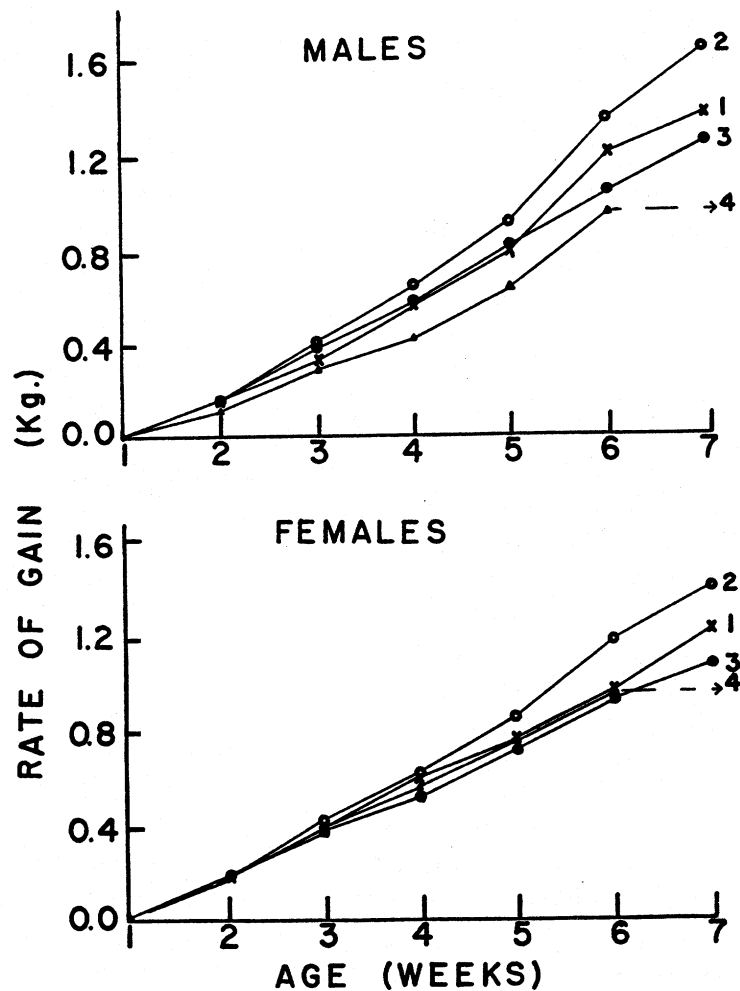


Fig. 1 Rate of gain of male and female pups from the first to 7th week of age. Curve no. 1—Basal ration; Curve no. 2—Basal + 4% animal fat; Curve no. 3—Basal + 8% animal fat; Curve no. 4—Basal + 18% sucrose.

The average food and caloric efficiency results from the lactating bitches are shown in table 2. These data show excellent caloric utilization of the fat during lactation whereas the calories added as sucrose were not as efficiently utilized as the calories of the basal ration or the rations containing 4 or 8% added fat. These findings indicate that the addition of fat may have enhanced utilization of the crude calories of the basal ration during lactation.

TABLE 3
Rates of gain of male and female pups from 5th-7th week of age

RATION FED BITCH	LITTER NO.	MEAN GAIN ♂ <i>gm</i>	MEAN GAIN ♀ <i>gm</i>	OVER-ALL MEAN ¹ <i>gm</i>	ADJUSTED MEAN ² <i>gm</i>
Basal	I	633	481	504	467
	II	398	360		
Basal 4% fat	I	626	482	586	590
	II	717	538		
P value				less than .15	less than .05

¹ Adjusted for sex variation.

² Adjusted for sex and litter variation.

SUMMARY

The maintenance, reproduction and lactation performances of Cocker Spaniel dogs fed since weaning a basal ration either with or without the addition of 4 or 8% fat (anti-oxidant stabilized choice white grease) or 18% sucrose were observed. The addition of 4 or 8% fat or 18% sucrose increased the efficiency of the ration for maintenance of the females prior to breeding.

The reproduction performance of bitches fed the basal ration plus 4% added fat was somewhat better than the performance of bitches fed the basal ration. The addition of 8% fat to the basal ration appeared to reduce the reproductive capacity of the bitches as judged by the number of pups dead 24 hours after birth, and the weight of the pups at birth, al-

though this result may be due in part to the larger number of pups born per litter for this group. The reproduction capacity of bitches fed 18% added sucrose was poor.

The average rate of gain of pups from bitches fed 4% added fat was higher than any of the other groups tested. This difference was primarily due to greater weight gains in the second litter for this group as compared to those for the basal ration, and was statistically significant. The average rate of gain of pups from bitches fed 8% added fat or 18% added sucrose was slightly less than that for pups from bitches fed the basal ration.

The addition of 4 or 8% fat to the basal ration increased the average food and calorie efficiencies of the lactating bitches when compared to the basal ration.

On the basis of all criteria used, the results obtained were excellent when 4% animal fat was added to the basal diet.

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